R E M A R K S

The Examiner has rejected claim 1 of the present application under 35 USC 103(a) as being unpatentable over Schoenbach (Bacterial Decontamination of Liquids with Pulsed Electric Fields) in view of Doevenspeck (US 3 679 556); he has rejected claim 2 under 35 USC 103 in view of the same references and further in view of Mittal et al (US 6 093 432), and he has rejected claim 3 under 35 USC 103 further in view of Cheever (US 4 305 000).

As noted already in an earlier response Schoenbach discusses the effect of pulsed electric fields on the viability of microorganisms, mainly bacteria, in liquids when subjected to pulsed electrical fields. It examines the effects of different electrical pulse parameters such as pulse shape, amplitude, duration and single-shot versa repetitive treatment.

Doevenspeck (US 3 679 556) discloses a method and device for treating disperse systems, particularly beer, including a cascade container 12 provided with spaced negative carbon electrodes walls 13 and positive carbon electrode walls 14 arranged between the negative carbon electrode walls 13 so as to form parallel passage delimited at opposite sides by positive and negative carbon electrode walls with the liquid, specifically beer, being conducted through the passages. Liquid supplied by the supply pipe 10 flows through the passage back and forth between the opposite positive and negative carbon walls in a labyrinth path as indicated by the arrows A. Alternate carbon electrode walls are charged negatively and, respectively, positively so that adjacent carbon electrode walls, that is, the walls at opposite sides of each passage, are oppositely charged and electric and magnetic fields are generated in the flow passages between the electrodes with field lines extending between the opposite electrodes through the passage exactly normal to the flow direction of the liquid flowing through the passages.

Mittal et al. (US 6 093 432) discloses a method and apparatus for electrically treating foodstuff for preservation wherein the foodstuff is moved through a treatment chamber in which it is subjected to electrical pulses for non-thermal pasteurization and sterilization. Instant charge reversal electric pulses are applied to the foodstuff in the treatment chamber between the two electrodes, each pulse having a width of $1 - 5\ \mu s$. These relatively low-energy pulses have been found to have high microbial killing power. The apparatus uses an electrode arrangement including a cylindrical inner electrode and an annular disc surrounding the cylindrical electrode in spaced relationship so that an annular gap or passage is formed between the cylindrical inner and the annular outer electrode through which passage the foodstuff is moved.

Cleever (US 4 305 000) discloses a process and apparatus for producing relatively low energy electron beams through pulsed cold-cathode beam generation in a way which reduces the sensitivity to voltage variations using improved triggering structures providing for increased reliability and minimum erratic pulse generation and missing pulses for application in production line sterilization of surfaces, materials or workpieces. The pulses are generated by a Marx generator and are conducted to the spaced radiation generators from which they are emitted via the opposite windows as indicated by the arrows in Fig. 2 in a direction exactly normal to the movement of the web W passing through space between the opposite windows 1, 1'.

The present invention resides in a method for a continuous non-thermal decomposition and pasteurization of industrial quantities of organic process material by electroporation wherein the process material is carried through a reactor in which it is subjected to the effects of pulsed electric fields generated between grounded electrodes which are arranged spaced from one another on one side of a longitudinal passage of the reactor and high voltage electrodes which can be energized by a high voltage and are arranged in spaced relationship on an opposite side of the longitudinal flow passage of the reactor opposite the spaces between the grounded electrodes. Pulsed electric fields are generated between groups of high voltage electrodes and the grounded electrodes by discharging an electric energy source connected to the high voltage electrodes by way of an associated switch such that no electroporation field axes formed thereby and extending between any high voltage electrode group and the grounded electrodes extend normal to the flow direction of the process material flowing through the longitudinal flow passage. Between two immediately successive discharges the electric energy sources are charged to such a level that, in the area between an electrode group and the nearest grounded electrode, an electric field strength E is generated during the discharge whereby along the longitudinal axis (2) of any cell of the process material which is momentarily present in the electroporation field a potential difference threshold $\Delta\varphi_s = 10$ V as required for the irreversible fracture and opening of the cell wall is exceeded.

Claim 1 has been amended so as to define the invention in a more distinct manner.

In his response to Arguments, the Examiner states that "Applicant argues that the field lines in Doevenspeck extend normal to the flow direction of the process liquid flowing through the flow passages and that Doevenspeck does not disclose electroporation field axes between

the electrodes of the flow passages which extend normal to the flow direction of the process fluid". This statement is not correct. There is rather said on page lines 1 - 3 of Applicants arguments that "Consequently, also Doevenspeck does not disclose, or in any way suggest, that there are no field axes between the electrodes of the electrodes of the flow passages which extend normal to the flow direction of the process fluid.

Then the Examiner states that "Doevenspeck discloses a flow through device for sterilizing liquids using electric fields having positive and negative electrodes distributed in alternating positions. The electrodes are distributed over a longitudinal area of the reactor where the bottom electrodes are grounded. The alternating positive electrodes (14) and the grounded negative electrodes (13) in Doevenspeck are like the alternating electrodes of Fig. 2 of the specification where such a geometrical positioning of the electrodes results in having no electric fields axes that extend normal to the longitudinal axis of the reactor".

This again is an incorrect statement: It is rather said in claim 1 that the electrode arrangement is such that no electroporation field axes formed thereby and extending between the electrode groups extend normal to the flow direction of the process material flowing through the longitudinal flow passage.

In Doevenspeck the electrodes extend from the reactor walls into the reactor toward the opposite walls so as to form flow passages between the electrodes which extend normal to the longitudinal reactor axis and practically all field axes or field lines extending between the adjacent electrodes will extend normal to the electrodes that is parallel to the longitudinal axis of the reactor so that – as stated by the Examiner -- no electric field axes extend normal to the longitudinal axis of the reactor, that is, all electric field lines or axes extend exactly normal to the flow direction of the liquid through the passages between the electrodes. In contrast, as defined in claim 1, and contrary to the Examiners allegation, the electrode arrangement along the walls of the flow passage in accordance with the present invention is such that none of the electric field axes extends normal to the flow direction of the liquid flowing through the flow passage between the electrodes.

Claim 1 has been amended slightly to more clearly define the invention in order to help eliminate any misunderstanding by the Examiner and any misinterpretation of the claimed subject matter.

As explained already above, Doevenspeck includes flow passages between parallel electrodes extending into a reactor housing from opposite walls thereof so that the electric field lines established between the opposite electrodes extend exactly normal to the electrode surfaces and normal to the flow direction of the liquid flowing through the passages between the spaced electrodes, that is all electric field lines extend in the same direction.

In contrast in the present invention, the electrodes are arranged along the side walls of the flow passages (they do not extend into the flow passage through a reactor) in spaced relationship so that an electrode-free area is formed between the electrodes arranged on one side wall of the flow passage, and the electrodes arranged on the opposite side wall are arranged opposite the electrode-free area of the one side wall so that any field lines or axes of a bundle of field lines extending from an electrode on one side of the flow passage to any electrode on the other side of the flow passages extends at an angle other than 90° with respect to the flow direction of the liquid through the flow passage, that is, no electroporation field lines or field line axis extend normal to the flow direction of process material flowing through the longitudinal flow passage.

It is hoped that the Examiner now understands the invention that is, that claim 1 as amended defines the invention in a manner so that it cannot be misunderstood. This concept is certainly not disclosed in Doevenspeck nor is it disclosed in any of the other references cited by the Examiner.

At this point, it is noted that Schoenbach is not concerned with an industrial process of treating materials but rather with the scientific determination of conditions for the destruction of living cells in liquids by exposure to pulsed electric fields, whereas the present invention is concerned with the most effective apparatus and method of achieving that object. Naturally, Schoenbach does not disclose such an apparatus or continuous method. But neither does any of the other references cited by the Examiner as none of the references discloses an arrangement as defined in claim 1 where the electric fields generated in a fluid flowing through the fluid flowing through a passage extend at an angle other than 90° with respect to the direction of the fluid flow. Note that the field is established between one electrode on one side wall of the passage and electrodes arranged at the opposite wall of the passage but not at a location directly opposite the one electrode but electrodes spaced from the location opposite the one electrode. In this way, inclined electric fields are established in the flow passage, which do not

extend normal to the flow direction of the fluid in the passage but rather two field line bundles are formed extending between an electrode at one side of the passage and the two displaced electrode at the opposite side wall of the passage with axes that are oppositely inclined as clearly indicated in Figs. 1-4.

This arrangement has been found by the inventors to be superior to conventional arrangements where all the field lines extend through a flow passage in a direction normal to the flow direction that is all extend in the same direction through the fluid flow.

It is explained on page 10 of the description, paragraph 1, that biological cells are in most cases elongated and may be arranged in different orientations in a liquid, that is, with their longitudinal axis for example, parallel to the local field direction in which electroporation is achieved or with their short axis oriented in the direction of the local field where a smaller potential is effective on the cells and in which position a cell may survive.

With the present invention, a cell surviving passage through a field oriented in one direction still must pass a field oriented in another direction so that the chances of survival are greatly reduced or the changes of sterilization are greatly improved.

The Examiner agrees that the invention is not anticipated by the cited references, but it is certainly also true that no combination of the cited reference would lead a person skilled in the art to the invention as defined in claim 1 as explained herein. And, consequently, the invention can also not be considered to be obvious from the cited references.

Reconsideration of the rejection of claim 1 under 35 USC 103 is respectfully requested.

Claims 2 and 3 define particular features considered to be advantageous in connection with the subject matter as defined in claim 1. These claims depend directly or indirectly on claim 1, and consequently, include all the features of claim 1 so that claims 2 and 3 should be patentable already for that reason.

Reconsideration of claims 2 and 3 is also requested and allowance of claims 1 – 3 is solicited.

Respectfully submitted,

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